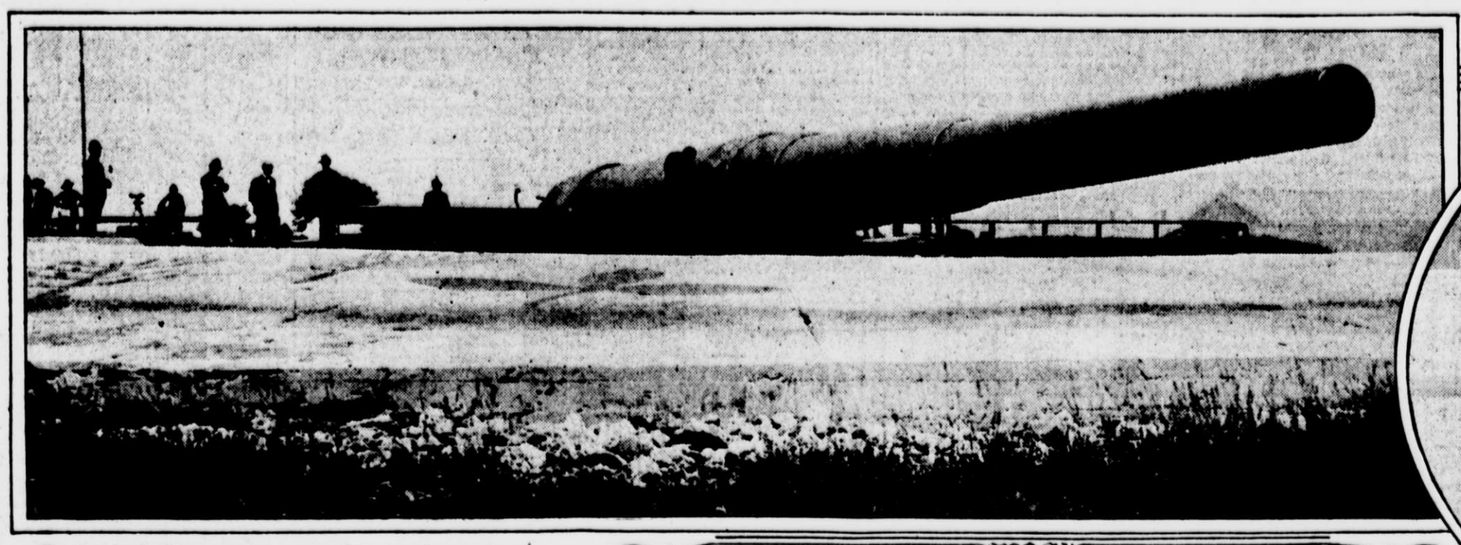
HOW UNCLE SAM'S COAST GUNNERS MAKE PERFECT SCORES



Twelve inch disappearing gun and its emplacement at Fort Wright.

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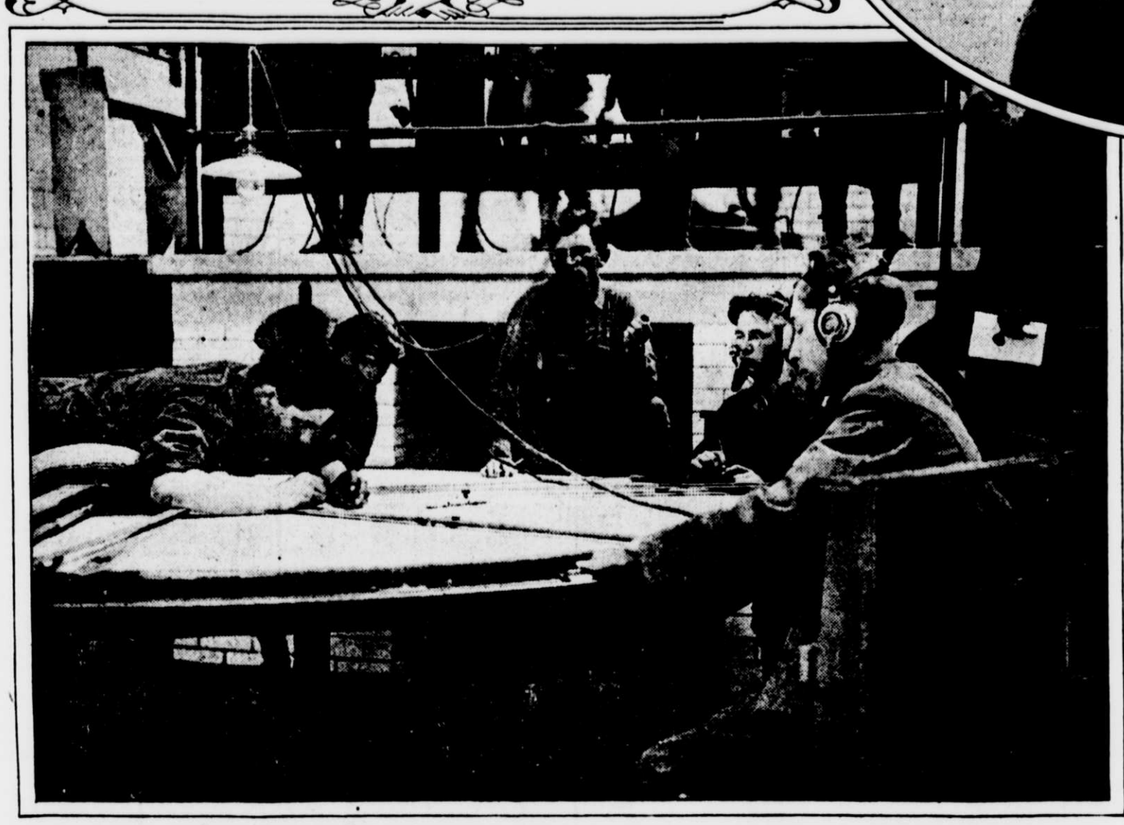
Using a telescopic range finder at Fort Wright, Fisher's Island.



Eighth Coast Defence artillerymen plotting targets in the chartroom at Fort Wright.

Coast Artillery Arm of the Service Still Pronounced Wofully Deficient in Trained Men

Method of Pointing Heavy Guns From Concealed Emplacements Now Reduced to Exact Science

NOW that President Wilson has let it be known that he intends to give the national defence immediate attention, public interest is again directed to our coastal batteries. It is upon these seaboard guns that the security of the nation will depend should an enemy succeed in crippling our far flung line, the navy, and drive our dreadnoughts to the cover of the harbors and the protection of the heavy rifles and mortars of the army. The question is, can these seaboard batteries hold a foe at bay?

On our continental shores we have a total of twenty-six coast defence commands, and twenty-one of these are located upon the Atlantic littoral. But even though there are fewer stations on the Pacific coast, still those are very formidable. Without considering weapons of 8 inch calibre and under, we already have mounted a total upon our two shores of 372 12 inch mortars, 105 12 inch rifles, and 132 10 inch heavy guns. The strength of the personnel of the coast artillery, according to the latest figures, is 758 officers and 17,991 enlisted men. This is a shortage of soldiers of 1,420 agreeably to the force authorized by law, and this is an intimation of the extremely heavy work that the men would have to face in case of hostilities, because we are minus a vitally necessary reserve.

True, we have in certain of the State militias companies of coast artillery, and the total of these available number 441 officers and 7,122 men in the ranks. Gen. Erasmus M. Weaver, U. S. A., Chief of Coast Artillery Division, was asked this question a few months ago: "In case of war could those men take their places in these coast defences?" And Gen. Weaver answered: "They have been instructed quite a way in that direction. You will understand, of course, that in such a technical service as ours is it is impossible for troops serving in this way to be wholly efficient when war comes, but we are able to carry them a long way in that direction."

The man who fears for his property will then ask, What force should we have for our coastal batteries? And again, Gen. Weaver replies: "The total regular Coast Artillery personnel required for this purpose is 1,312 officers and 30,309 enlisted men, and the total Militia Coast Artillery required is 740 officers and 18,531 enlisted men, making a total of regulars and militia required of 2,052 officers and 48,840 enlisted men.

"We have now 1,199 officers and 15,023 men in the ranks, counting the men in the regular army and the partly trained coast artillery of the militia. Service in the coast artillery is hard and heavy work and it lacks some of the showy qualities that lure citizen soldiers to other branches of the militia.

The average layman has but the slightest knowledge of the extremely technical character of the Coast Artillery Corps, and to be proficient these soldiers receive a many sided education. Theirs is the task of getting the advantage of the enemy before the foe can locate the position of our guns and mortars, and the whole system of defence is the exact opposite of the way in which a hostile squadron would approach its aggressive task.

From the very beginning of the planning of our existing seaboard batteries the idea of concealment was the first concern. The mortars were designed to be hidden away in pits—each of them holding four of these weapons. The heavy rifles were not to be in plain sight, with their threatening muzzles peering over the crests of parapets. Instead, the disappearing carriage was invented for a mount. These gave the rifles the power to crouch while loading or awaiting service, and then, when the moment for action arrived, to spring up suddenly from behind their embrasures, to fire directly at the foe, and by the force of their own recoil to sink from view and into position for reloading.

How is it possible for weapons of this sort to be aimed at their targets? It is commonly known that in naval service the guns are held upon their quarry by means of electrically operated mechanisms that swing and elevate the rifles so that the cross hairs of the telescopic sights can be kept right on a moving target even though the sea be rough and the vessel roll. The gun pointers are undisturbed by this motion, and at 12,000 yards and more are able to do some wonderful shooting. But the gun pointers and trainers in the mortar pits and the emplacements of the big rifles do not, themselves, see the enemy. Yet despite this seeming handicap still they are able to do some extraordinarily effective work.

Until a few years ago the coast artillery fired at hypothetical targets representing a battleship—in other words, the target had no existence, but a range was given and the splash of the shots within areas estimated by observers decided whether or not hits would have been made had a floating object been inside that zone. There was considerable room for error on the part of the observers, and the gun pointer lacked the satisfaction of seeing the result of his work—indeed, it was sometimes days before he knew whether or not the umpires had credited him with a score or a miss.

Then came a change in the manner of training, and it soon proved that the soldiers of the coast artillery needed only decent encouragement to show their skill. A real target was substituted for the imaginary one. This was a rectangular affair sixty feet wide and thirty feet high, covered with a net or screen attached to masts supported by a float or raft. This material target eliminated all uncertainty by enabling hits to be counted by actual holes made in the screen. It was no longer a process of determining scores by observing splashes and bothering with mathematical calculations.

As a matter of record, the army gun pointers near New York, with 10 inch disappearing rifles, have been able to fire four shots in a total elapsed time of less than one minute, and these were concentrated upon a target four miles away being towed at the rate of something over five miles an hour. All four shots struck the target and actually passed through a rectangle 24 feet high by 53 feet long. At 4,600 yards the same calibre guns at Fortress Monroe scored six hits out of six shots at a moving target. The total elapsed time of the firing was slightly over two minutes, the batteries scoring 1.4 hits per gun per minute.

The science of surveying has made these achievements possible, even though, as has been said, the guns and mortars must be trained and elevated by men who can not see their targets. It is a well known theorem in plane geometry that the length of the two sides of a triangle may be found if the length of the base and the degree of the two angles formed by the sides in question with this base are known. In the case of the coast artillery problem the distant ship of the foe is at the remote tip of the imaginary triangle, and the known base is the span between two observing or range finding stations. This interval may be a mile or more and, within some limits, the longer the better for accuracy.

Many have seen from afar at our coast defence stations what seemed to be big bird boxes mounted upon towering tubular supports or webwork of steel. There are always two of them, and officially they are known as the primary and secondary range stations. In each of them, in time of service, there are at least two men. One turns by means of a delicately graduated mechanism a powerful telescope from right to left, and his function is to keep the moving target continually at the point of intersection of two cross hairs in the field of his instrument. His companion reads off at prescribed intervals the angle made by the telescope with the permanent base and the far away foe.

The same thing is being done at the other range station at the opposite end of the base. A time bell rings at each of these stations every twenty seconds, and at the third stroke the man reading the angular scale telephoes that measurment to the plotting room located where the enemy cannot see it and itself in telephonic communication with each gun or mortar division.

In the plotting room a group of men make use of the information coming to them intermittently from the range finding towers and by a graphic process determine with great nicety the distance off of the steaming foe. The plotting table or board where the information from the observers is applied is a big semicircular affair—the curved edge being graduated to fractions of a degree, while the straight edge or diameter represents on a definite scale the length of the base line between the two spotter towers. At each end of this base line is a pivoted ruler. One is called the primary and the other the secondary—corresponding to the range finding station with which its operator is in touch by telephone. Here is what follows:

The soldiers at the primary and secondary pivoted rulers or arms bring the free ends toward one another in accordance with the separate angles telephoned to them. A third man operates another ruler called the gun arm, which measures the distance or range of the axis of this triangle. At the word of command from the range officer the observers at the two telescopes bring these powerful instruments to bear in unison upon a chosen part of the remote ship. At the order "Take," the scale readers telephone the figures to the operators at the plotting board. In a few seconds the man in charge there has placed on a large sheet of paper a dot at the point where the two straight edges meet and has marked this pencilled point No. 1.

Again, twenty seconds later, another dot is made where the shifting straight edges meet, and this is numbered 2. Similarly positions are thus recorded for No. 3 and No. 4, and if the distance between these dots is uniform the plotters know that the target is moving at a steady speed and the path of the dots gives a visible trace of the direction in which the foe is advancing. As yet none of the weapons has been pointed, nor, if mortars are to be used, even been loaded.

The plotter marks upon his paper a fifth point ahead and in line with the four other dots. This is his "predicted point" where the enemy vessel should be aminute later. In this interval of time it is necessary for the men in the plotting room to do a number of things necessary to make it possible for the weapons to score a hit. The mere range is not enough to know. Let us assume that the foe is to be attacked by means of mortars and that the projectiles are to soar thousands of feet into the air upon their long flight that may take the better part of two minutes before plunging upon the vulnerable decks of the hostile dreadnought.

It is needful to know how long the shells will be in the air at that range; how far the target will move during the flight of the missiles; how much the path of the projectiles will be influenced by drift due to their own rotation and the effect of the prevailing wind; the exact powder charge that will be needed to propel the shells—this being determined by the range and the state of the atmosphere; and finally, how much ahead the mortars must be aimed in order to allow for these factors. These complications are due to the method of indirect fire employed, and in this particular the mortars are not so accurate as the big rifles and, therefore, are more difficult to handle in order to insure good results. The final point set in the plotting room is No. 6 and two minutes further along than No. 5, the "predicted point," the latter being verified by the angles given by the observers at the spotter stations when the vessel is duly reported at the proper moment.

All of this has taken longer to describe than actual performance calls for, because the error factors which have been just mentioned are tabulated and are quickly worked out graphically by means of cunningly devised apparatus. It must be evident that in an interval of four minutes a big ship 12,000 or 16,000 yards off would not get measurably closer, and once the proper range is found and the mortars loaded the shifting range is quickly verified and the guns set accordingly.

The men in the towers and those in the plotting room are at work all the while. At definite intervals the instructions are sent by telephone from the plotting room to each battery or mortar pit, and lest these vocal directions be misunderstood the figures and orders are visibly reproduced. For this work the telautograph is employed, and thus words and numbers in writing check the telephone calls.

As has been said, there are four mortars in each pit, and as a general thing there are four of these pits at each defence station. In other words, a salvo of sixteen 12 inch, high explosive shells can be launched by indirect fire at a foe. If but two of these hit the enemy she would either be destroyed or gravely damaged, because none of her decks would be able to withstand such an assault. In practice the performances of such a battery have been splendid. As a matter of record, one mortar company has fired as many as ten shots in 6 minutes 49 seconds, and in that interval made six hits, while another company has scored eight times out of ten shots during a span of 9 minutes 28 seconds. These mortar projectiles weigh from 800 to 1,000 pounds and are charged with from thirty to sixty pounds of high explosive!

For the disappearing guns the modus operandi differs in some particulars. The time of flight of the shot is far shorter than in the case of the mortar shell, the powder charge is not varied to suit different ranges, and the state of the atmosphere is not a deciding factor. Therefore, corrections are more easily made, for the rifle, when it does fire, is pointed right at its target. The principal concern of the battery commander is to know the range, and this is telephoned and reproduced by the telautograph at the firing stations.

The battery commander also follows the enemy ship with a telescopic range finder that employs a short vertical instead of a horizontal base. This serves as a check and at each gun there is a telescopic sight which is functioned independent of the weapon—the operator looking over the parapet and following continually the moving quarry. By swinging his telescope horizontally he causes the lateral angle to be indicated at the gun station below, and there the trainer swings the weapon in unison and the elevator raises the muzzle agreeably to instructions from the range-finders.

When the rifles have been loaded and the moment for action arrives these great war dogs rise upon their steel haunches and thrust their muzzles above the heavy parapets of concrete. Instantly there is a thunderous boom—the speeding projectiles are on their murderous mission. Before the thin veil of smoke has been swept aside the guns have sunk behind cover, and but for the momentary flashing of their muzzles there is nothing to show the spotters on the hostile craft where the attacking guns lie.

The fire control system employed at our coast defence stations is extremely flexible and withal capable of meeting the needs of the hour even though parts of it be totally destroyed. Indeed it is said that should all of the regular range finders be put out of service there are still emergency range finders that can be called upon to do reasonably accurate work. These are placed on one flank of every battery and are much like the separate range finders that we now see mounted on top of the turrets of our dreadnoughts. These are self-contained affairs about 8 or 9 feet long and are cunning examples of the climax of the optician's art.

TRIP IN NORTH SEA NOW IS FULL OF EXCITEMENT

Mere Embarkation for Continent Proves Exacting Experience and Mines Add to Anxiety

By J. HERBERT DUCKWORTH.

"WHAT does the North Sea—the war zone—look like?"

"Did you see anything of the German or English fleet?" These and other similar questions have I been asked a hundred times by my friends who knew that I had made the short sea trip through the mine fields from Harwich to the Hook of Holland during war time.

To be truthful I must admit that I saw neither Admiral Jellicoe's grand fleet nor the high sea fleet of Admiral von Tirpitz sweeping majestically across the face of that very inhospitable looking stretch of cold, gray, troubled water. But I did learn a lot of what an amazing number of interesting naval details are necessary for England to hold the command of the sea. And the so-called war zone, so far as I could see, was most decidedly swept clear of every vestige of German shipping, either of a warlike or peaceful nature.

It must be almost as easy to break out of Pentonville jail as it is for an unauthorized traveller to leave the shores of England for the Continent these troubled times. Before the steamship company would even sell me a ticket I was obliged to show my passport, vised by the Consulate-General of the Netherlands. American tourists returning from Europe have grumbled and growled for years at the impolite inquisitiveness of the United States customs collectors. These New York dock formalities are dignified and gracious acts of courtesy as compared to the third degree indignities heaped upon a poor, unsuspecting passenger about to embark at Parkeston Quay, Harwich, for Holland.

Under, I suppose, the all embracing scope of the defence of the realm act the traveller has not only to turn his baggage inside out, but is in addition bustled into a draughty improvised "examination room" and there compelled to strip down to his union suit in order to prove, no doubt, that he has no heavy ordnance or other contraband destined for the enemy concealed about his person.

There was more bother when we got aboard, for the vessel was not permitted to sail until we had been shown by the first officer how to put on a lifebelt. The whole harbor was heavily mined, we were informed, and even if we were not blown to smithereens by a "friendly mine" we might meet with less consideration later on at the hands of the commander of a German submarine.

There was plenty to see as we slowly steamed down the harbor. Harwich is one of the bases of the "Mosquito Fleet." That is, within its well protected anchorage—for the fortifications of the place have been vastly strengthened during the last ten years—flotillas of 40 knot destroyers, light cruisers, submarines and seaplanes, whose chief work is to patrol the North Sea, operate.

War has wrought a vast transformation at Harwich. In times of peace this quaint old Essex seaport is one of the most popular yachting centres on the east coast. To-day the clubhouse of the Royal Yacht Club, which, by the way, received its Admiralty warrant just seventy years ago this summer, is a Red Cross hospital, and is full of wounded sailors and marines. Gone are the flannelled yachtsmen and pretty women from the quay and jetty. In the place of gayly rigged yachts, riding lightly at anchor in the roadstead or sailing serenely down the Stour with white cutspread canvas, are low lying, devilish looking destroyers and submarines resting in a half awash condition. Instead of yacht rigs bobbing to and from the pleasure craft are noisy naval steam pinnaces keeping up an unceasing communication between the fleet and the shore.

An Admiralty pilot had charge of our ship, and as an additional precaution we were shown the way out through the mine fields by a superannuated torpedo boat. Right in the middle of where we imagined one of these mine fields was laid out to keep the German U boats away was moored the training ship Ganges, whose rigging and decks were swarming with the boys who will form the next generation of British sailors.

As we passed Landguard Fort at the mouth of the estuary and were signalling to somebody or other about something or other—it must have been rather important judging from the commotion on the bridge—two huge seaplanes appeared in the sky from the direction of Felixstowe, where there is a station of the Royal Naval Air Service. The aviators circled around our ship once or twice, and then headed out to sea.

It was a ticklish job getting out of Harwich harbor. Our course reminded me of the snake dance after a Yale-Harvard football game. We zigzagged from one side of the estuary to the other, turned in our own length, crossed our own wake and went "full speed ahead" and "full speed astern" half a dozen times before we got clear. We could not see the mines, but were given to understand that the water was filled with them, and that not more than a dozen Admiralty pilots knew the secret of the way in and out.

For the first hour and until we had got well out of sight of land not a thing happened to relieve the tension under which we were all laboring—and I suppose every one of us felt that he was really doing a very plucky thing to cross this sheet of water on which both the English and the Germans have threatened to blow each other off the earth the first time they met.

At last we spotted something on the horizon. Was it a German or a British fleet? There was a wild scramble for marine glasses, telescopes and even opera glasses. We were going to get some excitement after all. But in a few minutes and before we could ascertain the nationality of the craft a haze blotted out everything from view. This was a pretty business. Supposing that we were to be trapped and submarined by a German patrol. We all had cold shivers up and down our backs. Why didn't the captain turn back? What was the use of needlessly running into danger? And yet the captain seemed to be cool and unperturbed.

We were just about to make up our minds that the best thing to do would be to adjust lifebelts around our middles when the sun burst forth and dispersed the haze. And then to our utter amazement and half disappointment we found ourselves in the midst of a fleet of fishing vessels that, judging from the large "Y" painted on their mainsails, hailed from Yarmouth, made famous by the humble bloater and the German bombardment.

Well, this didn't look as though there could be much truth in the oft repeated boast of Admiral von Tirpitz that he was constantly sweeping the North Sea, from the Orkneys to the Straits of Dover, and that he was totally unable to find a trace of an enemy ship. Away in the offing we noticed that a destroyer was watching the fishermen as a hen does her chicks.

An hour later and the fishing fleet was left far astern. By this time the sea seemed to be absolutely deserted save for a few sportive porpoises that raced with us about half a mile off the port beam. Not a battleship, submarine, Zeppelin or aeroplane was in sight. Feeling very disappointed we obeyed the call of the steward's bugler and went down to lunch, the menu for which, we all noted, invited us to partake of several varieties of fresh fish after we had whetted our appetites with Bismarck herring.

But we got our reward early in the afternoon. Away on the horizon to the northwest we detected smoke—a lot of it. We guessed that this time we were certainly going to run into some warships. Away above the smoke, and much nearer to us, we could discern three giant seaplanes heading for us. In about fifteen minutes they were near enough to swoop down upon us, evidently to see whether we were friend or foe. We hauled up some flags, evidently a prearranged signal, and seemingly satisfied with our identity and innocent character they left us as silently and as swiftly as they had come.

As the smoke came nearer we could see that it came from a flotilla of eleven torpedo boats. They were Britishers we were told. As they crossed our bow, as they did presently, it was easily seen that high speed is the note of the torpedo service; that weather is no bar to its activities; that to be washed down fore and aft as the boats crash into a head sea, or to ship it green first on one side and then on the other, must be the regular routine of these small craft when they run in front of the wind when there is anything like a sea.

These, the patrol flotillas, are indeed and in truth the "Wards of the Outer March." Questing, doubling, turning, strung out like a flight of seabirds, obedient to the call of their leaders, they ring and guard the coasts of the British Isles. Now, when the time of battle has come, these are the men and these are the ships that are in the very forefront. The way in which war is regarded in the fleet was neatly summed up in a letter from an officer in the North Sea who wrote: "We are greatly enjoying the rest of war after the strenuous times of peace."

How strenuous the times of peace may be was exemplified in a cruise made by the patrol flotilla from Harwich one December. As soon as they got clear of the land it began to blow, and the same night it hardened down into a northwesterly gale of the bitterest description. Although the water froze as it broke aboard, things were not too bad until they were off the Wash. "Then," said the officer who told the story—he was one of the lieutenants in command—"we all thought that we were done." There was such a frightful sea on that I had to lash myself to the bridge rails and pray that they wouldn't be washed away.

At the end of twenty-four hours of this purgatory the flotilla intact put into Grimsby, where they had to beat the ice away from the anchor before it could be let go. At last the welcome rattle of the chain through the hawsehole was heard.

We did not notice anything more of particular interest until we began to approach the coast of Holland, when somebody suggested that smoke we could see a long way off to the southeast must be rising from somewhere near Zeebrugge. We would all have liked very much to have believed this was the case, but somehow our imaginations were not nimble enough to accept the explanation.

We were moving along at about half speed somewhere off Middleburg, where the big firms of English bookmakers, or "commission agents," carry on, or used to carry on, their illegal business before the war, when a pompous looking little Dutch Government tug came alongside, and a Dutch naval officer climbed aboard to look over our ship's papers and to see that we were not smuggling in a British army corps to outflank the Germans.

At the dock there was a further examination of papers and baggage, and we were then more or less free to roam all Europe if we were neutrals, or at least the Netherlands if we were British or other allies.

Seaplanes and Torpedo Boats Constantly Patrol, Only Other Craft Being Fishermen